

BIOCHIPS An analytical laboratory on a slide

APPLICATIONS

Identification of infectious disease or biological warfare agents in the field as well as in hospitals and other laboratories.

- Protein assays
- Pathogen detection (bacteria, viruses, parasites, protozoa)
- Host immune profiling
- Chemical agents
- Gene detection
- Functional enzymes
- PCR/amplification

BENEFITS

- Easy sample preparation and standard operating protocols suitable for use in the field.
- Portable biochip reader smaller than a lunchbox
- Reusable biochips
- Fully automated software for identifying and reporting agents
- Readily usable by first responders, military personnel, medical technicians
- Environmental and medical applications
- Chips can be tailored to individual user needs, and mass-produced cost effectively
- Unlimited PCR multiplexing capability from a single sample and test
- Simultaneous spatial resolution of thousands of diagnostic tests from a single sample

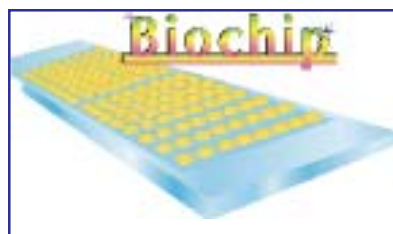
A system for rapid identification of biological and chemical agents using reusable biochips and a portable reader

BIOCHIPS carry a high-density array of test sites that can analyze a single droplet of a sample for hundreds to thousands of biological agents simultaneously. The system developed at Argonne can complete such identification of infectious disease strains or biological warfare agents in less than two hours.

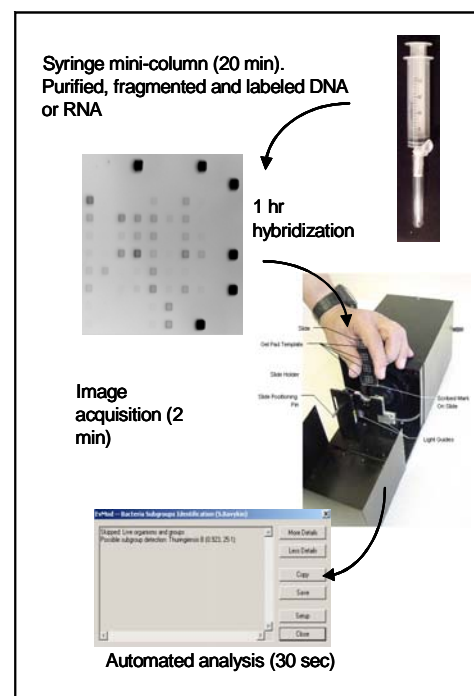
Argonne's **BIOCHIPS** contain hundreds to thousands of test sites, each chip being a matrix of three-dimensional gel pads about 100x100x20 microns in size (100 microns is about the width of a human hair).

- Thousands of individual test sites can be immobilized on a 1x3 inch glass or plastic substrate.
- The array of sites can be tailored for the specific needs of users, whether to detect bioterrorism agents, specific strains of infectious diseases or other biological organisms.
- Each site can detect the presence of trace quantities of the agents for which they are set up.

How Argonne's **BIOCHIP** System Works



Each **BIOCHIP** has hundreds to thousands of gel pads. A segment of a DNA strand, protein, peptide or antibody is inserted into each pad, tailoring it to recognize a specific biological agent or biochemical signature. These pads are in known



Complete analysis in two hours or less

OVERVIEW: Argonne Homeland Security Technologies

CONTACT INFORMATION

For inquiries related to DHSARPA proposals, contact: Rebecca (Becky) Winston, JD Director, Homeland Security Programs Argonne National Laboratory 208-533-7091 (phone) 630-252-8331 (phone) 208-371-4945 (Blackberry) rwinston@anl.gov

For all other inquiries, contact: Darrell P. Chandler Biochip Technology Center Argonne National Laboratory 630-252-4229 dchandler@anl.gov

ABOUT ARGONNE TECHNOLOGY TRANSFER

Argonne National Laboratory is committed to developing and transferring new technologies that meet industry's goals of improving energy efficiency, reducing wastes and pollution, lowering production costs, and improving productivity. Argonne's industrial research program, comprised of leading-edge materials research, cost-saving modeling, and unique testing and analysis facilities, is providing solutions to the challenges that face U.S. manufacturing and processing industries.

positions so, when a sample reacts, the reaction position can be detected, identifying the sample.

The system makes use of the polymerase chain reaction (PCR), a universal method for converting one piece of genetic material into billions of copies. PCR is, in effect, a biological amplifier that enables low-abundance bacteria and threat agents to be detected with relative ease, within hours instead of days. Using Argonne's **BIOCHIP** allows a multitude of such bacteria and agents to be detected simultaneously from a single sample.



Reading a biochip

A prepared sample is applied to a **BIOCHIP**. The **BIOCHIP** is put in a reader and scanned using laser technology, detecting reaction sites. Automated algorithms determine the agents present in the sample.

Research is underway to shorten sample-preparation time to about 10 minutes and increase system sensitivity, allowing full analysis to be done in less than one hour. Such research includes embedding sample preparation chemistry into a single-use, user-friendly fluidic card.

Argonne's **BIOCHIP** system:

- Provides a universal platform for both protein and nuclear acid immobilization
- Immobilized molecules are strongly bound to the gel and retain their biological function
- Demonstrates specific molecular interactions.
- Has no detectable non-specific binding to the gel matrix.
- Versatile design and manufacturing process allows chips to be produced for many different purposes.

Estimated costs for field portable system:
Per instrument: about \$12,000
Per test: \$2-3

